What is the source of L1 attrition?

What is the source of L1 attrition? The effect of recent L1 re-exposure on Spanish speakers under L1 attrition*

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Abstract

The recent hypothesis that L1 attrition affects the ability to process interface structures but not knowledge representations (Sorace, 2011) is tested by investigating the effects of recent L1 re-exposure on antecedent preferences for Spanish pronominal subjects, using offline judgements and online eye-tracking measures. Participants included a group of native Spanish speakers experiencing L1 attrition ('attriters'), a second group of attriters exposed exclusively to Spanish before they were tested ('re-exposed'), and a control group of Spanish monolinguals. The judgement data shows no significant differences between the groups. Moreover, the monolingual and re-exposed groups are not significantly different from each other in the eye-tracking data. The results of this novel manipulation indicate that attrition effects decrease due to L1 re-exposure, and that bilinguals are sensitive to input changes. Taken together, the findings suggest that attrition affects online sensitivity with interface structures rather than causing a permanent change in speakers' L1 knowledge representations.

Keywords: L1 attrition, L1 re-exposure, eye-tracking, subject pronouns, Spanish

1. Introduction

First language attrition, and to a greater extent bilingual first language acquisition and adult second language acquisition, have been widely explored in relation to many factors, such as the stages in which these phenomena take place, the contexts in which they occur and the factors affecting them. More recent research has focused on the Interface Hypothesis (Sorace & Filiaci, 2006), which postulates that structures that involve an interface between syntax and other linguistic domains, such as semantics or pragmatics, are more difficult to acquire completely and are more open to native (L1) attrition than structures that do not involve such an interface. The current hypothesis is that individual L1 attrition affects only the ability to process interface structures but not knowledge representations themselves (Sorace, 2011).

The prediction made by the Interface Hypothesis has been supported by many studies exploring cross-linguistic influence effects for different interface structures in different bilingual groups, such as the influence of pragmatics in the acquisition of null versus overt pronominal subjects and objects (Argyri & Sorace, 2007; Belletti, Bennati & Sorace, 2007; Lozano, 2009; Montrul, 2004; Paradis & Navarro, 2003; Rothman, 2009; Serratrice, Sorace, Filiaci & Baldo, 2011; Serratrice, Sorace & Paoli, 2004; Sorace, Serratrice, Filiaci & Baldo, 2009; Tsimpli, Sorace, Heycock & Filiaci, 2004). However, Sorace's (2011) prediction that individual L1 attrition affects the ability to process interface structures but not knowledge representations has not been tested before. Therefore, the present paper addresses the question of whether attrition effects are restricted to the

processing of interface structures using a novel manipulation. Following Paradis's (1993) Activation Threshold Hypothesis (henceforth, ATH), which predicts that L1 attrition will occur when an element in the L1 is disused and it has a corresponding 'competing' element in the L2 that is used more frequently, a group of attriters was tested after being recently re-exposed exclusively to their L1, Spanish, to examine whether attrition decreases or disappears with re-exposure to the L1. This manipulation directly investigates the cognitive effects that attrition has on the bilinguals' L1, as well as the effects of input and exposure on the maintenance of their L1. If results show fewer or no attrition effects on the interface structure after L1 exposure, this will suggest that bilinguals are sensitive to input changes and that attrition effects are due to inconsistent or inefficient processing of interface structures in real time, rather than to a permanent change in the attriters' L1 knowledge representations (i.e. in their L1 grammatical competence). On the other hand, if results show the same level of attrition after this re-exposure to the L1, this could be attributed to more stable changes in the attriters' L1 knowledge representations.

2. L1 attrition effects on interface structures

Much previous research on L2 acquisition has focused on the influence of the L1 on the L2, but to a lesser extent, researchers have also investigated the influence that the L2 might have in the L1 of second-language learners. This phenomenon, known as 'L1 attrition', refers to the changes occurring in a speaker's L1 as the result of the acquisition of an L2 at an adult age, after the L1 acquisition process

has been completed. L1 attrition normally occurs in the L2 environment as a consequence of the speaker's immigration and consequent exposure to a great amount of L2 input, together with a drastic decrease in L1 input. Previous research on L1 attrition supports the Interface Hypothesis, revealing that the structures at the syntax-pragmatics interface are initially the most sensitive to attrition, causing emerging optionality[1] in the attrited speakers. It is therefore important to define the type of structures that require an interface between choice of forms and pragmatic conditions.

2.1 Anaphoric forms at the syntax-pragmatics interface

Much previous research has focused on the interpretation of anaphoric forms, such as pronouns, in null-subject languages, which are characterized by allowing the subject position of a finite clause to be phonetically empty. While pro-drop languages, such as Spanish, allow for either a null or an overt subject to appear as the subject of a sentence, as in (1a), in non-null-subject languages, such as English, the use of a null subject is usually ungrammatical, as in (1b), where '*pro*' represents a null pronoun.

(1) a. Pedro/*pro* salió del restaurante.

b. Peter/**pro* left the restaurant.

The distribution of null and overt subjects is pragmatically constrained by the features 'topic' and 'focus'. Specifically, in Spanish, a null subject is used when the referent has been previously introduced (i.e. when it is a topic), whereas a subject is overt if there is a change of referent or if new information is introduced

(i.e. when new information is in focus). In order to account for the division of labour between null and overt subject pronouns, Carminati (2002) proposed the Position of Antecedent Strategy (henceforth, PAS) for Italian intra-sentential anaphora. The PAS postulates that null pronouns are generally assigned to the antecedent in the highest SpecIP (generally the subject), whereas overt pronouns are generally assigned to an antecedent in a syntactic position that is lower than the SpecIP (generally the object), as (2) shows.

(2) Quando Mario$_i$ ha telefonato a Giovanni$_j$, *pro*$_i$/lui$_j$ aveva appena finito di mangiare.

"When Mario has telephoned Giovanni, (he) had just finished eating."

The PAS was shown by Alonso-Ovalle, Fernández-Solera, Frazier and Clifton (2002) to also apply to Iberian Spanish, with some differences: their results revealed that the null pronoun consistently prefers the subject antecedent, whereas the overt pronoun has more flexible preferences. These results indicate that there might be some differences among pro-drop languages in relation to the distribution of overt subject pronouns. Filiaci (2010) and Filiaci, Sorace and Carreiras (2013) compared pronoun-antecedent preferences in Subordinate-Main forward anaphora, like those in (2), by Spanish and Italian native speakers; their results revealed that while for the null pronoun there are no cross-linguistic differences between Italian and Spanish speakers, with both groups preferring the subject as its antecedent, preferences differ in relation to overt pronouns: Italian speakers consistently prefer the object as the antecedent for overt subject

pronouns, whereas the preferences of Spanish speakers are equally divided between the subject and the object antecedent.

2.2 Attrition in native speakers of null-subject languages

Tsimpli et al. (2004) reported attrition effects in Greek and Italian near-native speakers of English in relation to the interpretation of subject pronouns in Greek and Italian. They tested the interpretation of null versus overt pronouns using a Picture Verification Task (PVT) to elicit attriters' preferences for the subject or the object antecedent for each pronoun. Participants were presented with three pictures together with a sentence like those in (3), and asked to choose the pictures that correctly matched the meaning of each sentence.

(3) a. Quando **lei**/***pro*** attraversa la strada, l'anziana signora saluta la ragazza.
"While (she) crosses the street, the old woman greets the girl."

b. L'anziana signora saluta la ragazza quando **lei**/***pro*** attraversa la strada.
"The old woman greets the girl when (she) crosses the street."

For this task, Tsimpli et al. only present results for the group of Italian attriters, since no significant effects were revealed for the Greek attriters. Attrition effects were revealed for Italian attriters on their interpretation of the overt pronoun, for which they were more likely to show indeterminate reference than the Italian control group. In contrast, no attrition was found with respect to the null pronoun, for which both groups of attriters, like monolingual controls, preferred the subject referent as the antecedent.

Tsimpli et al. (2004) also investigated the interpretation of preverbal versus

postverbal subjects in Italian and Greek, where participants were presented with three pictures and a pair of sentences like those in (4) and asked to choose the pictures that matched the sentences, in order to test the L2 learners' preference for the 'old' (i.e. preverbal) referent, as in (4b), or the 'new' (i.e. postverbal) referent, as in (4a).

(4) a. I gitonisa mu ston trito orofo apektise dhidhima. Xtes vradhi ena moro ekleje.

b. I gitonisa mu ston trito orofo apektise dhidhima. Xtes vradhi ekleje ena moro.

"My neighbour on the third floor had twins. Last night one baby was-crying/was-crying one baby."

For this task, they only present results for the group of Greek bilinguals, since the Italian bilinguals did not reveal significant effects. The results for this task revealed attrition effects for the Greek group, since their interpretation of preverbal subjects was significantly more indeterminate than in the Greek control group. Tsimpli et al. concluded that these results support the hypothesis that attrition affects structures at the syntax-pragmatics interface but not purely syntactic features, which were in fact unaffected by attrition[2].

Gürel (2004) also found language attrition to be selective. She investigated the L1 attrition of null and overt pronouns in Turkish native speakers whose L2 is English. Turkish has two overt pronouns: *o* "s/he" and *kendisi* "self", as well as the null pronoun. All thee pronouns can appear in subject position, as (5) shows, and in object position, as in (6); however, only *kendisi* and the null pronoun can

co-refer with another subject when they appear in object position, but this is not possible for the overt pronoun *o*.

(5) O/kendi-si/*pro* Londra'ya git-ti.

(S)he/self-3SG/*pro* London-DAT go-PST.

"S/he went to London."

(6) Burak$_i$ o-nu$_{*i/j}$/kendi-si-ni$_{i/j}$/*pro*$_{i/j}$ beğen-iyor.

Burak (s)he-ACC/self-3SG-ACC/*pro* like-PRG.

"Burak$_i$ likes him$_{*i/j}$/self$_{i/j}$/*pro*$_{i/j.}$"

Participants' interpretation of sentences like (5) and (6) above was tested with a written interpretation task, a truth-value judgement task and a picture identification-listening task. Gürel reported that the interpretation of the overt pronoun *o* in Turkish was influenced by English L2, because attriters appeared to treat this Turkish overt pronoun as if it was the English overt pronoun, that is, as co-referential with the subject (e.g. 'John$_i$ believes that he$_{i/j}$ is intelligent', 'John$_i$ kissed his$_{i/j}$ wife'). The interpretation of the null pronoun and the overt pronoun *kendisi*, in contrast, did not show attrition. Gürel addressed this under Paradis's ATH, which predicts that L1 attrition will occur when an element in the L1 with a high activation threshold (i.e. infrequently used because of the limited L1 exposure) has a corresponding 'competing' element in the L2 with a lower activation threshold (i.e. used more frequently). Gurel's results are predictable under the ATH, because it is the Turkish overt pronoun *o*, which is in competition with the English overt pronoun, that shows attrition due to infrequent use in Turkish and frequent use in English, but the other overt pronoun or the null

pronoun in Turkish, which do not have a competing item in the L2, do not show attrition effects.

2.3 Convergence between L1 attrition and L2 acquisition

The patterns of emerging optionality attested in L1 attrition are strikingly parallel to those found in advanced L2 speakers. Sorace and Filiaci (2006) and Belletti et al. (2007) report on 'residual' optionality in the interpretation of Italian overt pronouns by English-speaking near-native speakers of L2 Italian. In one of the few studies using online experimental methods, Wilson (2009) and Wilson, Keller and Sorace (2009) investigated the online processing of German anaphora with demonstratives and pronouns, by English-speaking adult L2 learners of German and L1 German attriters (whose attrition was determined based on their length of residence in the UK, with a mean number of months of 36.54, *SD* = 35.77), using the visual world eye-tracking methodology. Participants were presented with a set of pictures while they heard a pair of sentences like those in (7) and were asked to answer a yes/no question that revealed their antecedent preferences for the pronouns. Similar to the distribution of null and overt pronominals in null-subject languages, there is a division of labour between anaphoric forms in German: personal pronouns preferentially refer to the subject antecedent and demonstrative pronouns refer to the object antecedent.

(7) **Der/Den** Kellner erkennt **den/der** Detektiv als das Bier umgekippt wird.
Er/Der ist offensichtlich sehr fleißig.

The-NOM/The-ACC waiter recognises the-ACC/the-NOM detective as the beer tipped over is. He-PRON/He-DEM is clearly very hard working.

"The waiter recognises the detective/is recognised by the detective as the beer is tipped over. He is clearly very hard working."

The results from these studies showed that while L2 learners performed similarly to German native speakers with pronouns, they showed indeterminacy with demonstratives, revealing no clear preference for the object as their antecedent. Similarly, attriters showed more attrition effects with demonstratives than with pronouns in comparison to monolinguals, also revealing no clear preference for a specific antecedent.

2.4 Cross-linguistic interference or bilingual strategy?

All the bilinguals in the studies reviewed so far had English as the other language. One plausible interpretation of the results is that there are interference effects of English, a language that does not offer a choice of anaphoric forms, on the language that does offer such a choice. However, the extension of the overt pronoun has also been found in adult bilingual speakers of two null-subject languages of the same type (Bini, 1993; Lozano, 2006; Margaza & Bel, 2006; Mendes & Iribarren, 2007; see also Sorace et al., 2009 on bilingual children).

These results are important for two reasons. First, they indicate that the asymmetric extensions of marked forms (Tsimpli, 2011) cannot be due only to interference effects from English – a language that does not offer a choice of anaphoric forms – but may result from the cognitive effort of handling any two

languages in real time (see Sorace, 2011 for further discussion). Second, the similarities between L1 attrition and L2 acquisition suggest that both languages of late bilingual speakers may be affected by cognitive changes required by accommodating a second language. The marked anaphoric form may become a 'default' option, both in production and in comprehension, that speakers resort to when they experience processing difficulties in computing pronoun-antecedent mappings.[3] The precise nature of these difficulties is still unknown: a current hypothesis is that these difficulties could be attributed to speakers' reduced efficiency when integrating information from different domains in real time and updating the mental discourse model when needed, possibly as a trade-off effect of the need to exercise inhibitory control to avoid interference from the unwanted language (Costa, Hernandez, Costa-Faidella & Sebastian-Galles, 2009; Green, 1998). If the effects of attrition do not involve the knowledge of the language itself, but rather the cognitive strategies to access and implement this knowledge in real time, one may predict that these effects are not irreversible but may be sensitive to the amount and frequency of exposure to the native language.

This is in fact the question addressed in this study: can attrition be (partially) reversed under sustained and exclusive re-exposure to L1 input? Following the predictions made by the ATH that frequency of use of an item determines its availability to be used by the speaker, we tested a group of attriters after they had been exposed exclusively to the L1 to explore whether sustained re-exposure can offset attrition effects.

3. Research questions and scope of the study

The present study addresses the following research questions:

(i) Following the Interface Hypothesis, will attriters show indeterminacy with an interface structure, such as pronominal subjects?

(ii) If they do, is the cause of the mentioned indeterminacy attributed to difficulties in processing interface structures in real time, or is it due to permanent changes in attriters' L1 knowledge representations?

(iii) Considering the ATH, does attrition decrease or disappear due to frequency and recency of re-exposure to the L1?

To explore these questions, this study investigates the interpretation and processing of an interface structure, Spanish pronominal subjects, by Spanish attrited speakers, who carried out two tasks. The first of these tasks was eye-tracking-while-reading, where participants' eye-movements were recorded while they read sentences containing pronouns that were biased for and against the expected antecedent preferences. The eye-tracking task was designed to probe the moment-by-moment process of pronoun resolution. As we will discuss below, previous eye-tracking studies have shown that, under ideal conditions, L1 readers are able to resolve pronouns remarkably quickly. Since pronoun resolution involves the recruitment of diverse sources of information at the syntax-discourse interface, we hypothesized that this process (which is normally fast and efficient) would be disrupted for attrited speakers. The second task was a judgement task, where participants were asked to judge the naturalness of each sentence, immediately after having read it in the eye-tracking task. This naturalness

judgement task was intended to probe the underlying declarative knowledge representations that support pronoun resolution. Since participants were given unlimited time to evaluate each sentence, we assumed that judgements would accurately reflect this knowledge, whether or not it had been efficiently used during the initial reading of the sentence. Note that this is analogous to the assumption made by many theoretical syntacticians that grammaticality judgements reflect underlying syntactic competence.

We believe our two tasks map onto the distinction between (a) the actual process of pronoun resolution and (b) the declarative knowledge that underlies this task. The judgement task is probing the end point of processing, while the eye-tracking task is probing the step-by-step process of how the interpretation is built up. The basic idea is that, if people have the declarative knowledge that underlies the preferences of null and overt pronouns, then they should be able to use this knowledge to make the naturalness judgements, given (unlimited) time to make the evaluation. However, even if people have this declarative knowledge, they may not apply it quickly and efficiently during processing. The eye-tracking task allows us to test whether the preferences are applied quickly and efficiently during processing, but it does not tell us about the participants' final evaluation of the sentence, and vice versa for the judgement task.

4. Method

4.1 Participants

Three groups of participants were tested: ‘monolinguals’, ‘attriters’ and ‘exposed’. They were all from Spain and had no knowledge of any other language from birth (Spanish speakers from regions in which another L1 was spoken, such as Catalan or Basque, were excluded from the experiment).

The control group of ‘monolinguals’ (MON) were 24 Spanish native speakers (14 females, 10 males) who had recently arrived in Edinburgh (the mean number of weeks spent in the UK was 7.958, SD = 7.117), and had very little knowledge of English (considering that English is a mandatory subject in Spanish education, we assume that the participants have had some previous contact with the language). Participants were asked to complete a questionnaire and rate their use of the L1 and the L2 on a 5-point scale (1 = never; 2 = rarely; 3 = sometimes; 4 = often; 5 = always) in three different settings (at home, in their social circle and at their job or professional/educational setting) and MON used the L1 significantly more often than the L2 ($p < .001$). For the L1, the mean use across all three settings was 4.312, $SD = .639$; for the L2, the mean use was 2.708, $SD = .908$.

The group of ‘attriters’ (ATT) consisted of 24 Spanish native speakers (16 females, 6 males) who had been residing in the UK for a minimum of five years and were near-native speakers of English (the mean number of years spent in the UK was 7, $SD = 2.844$). This group, unlike MON, used the L2 significantly more often than the L1 ($p < .001$). For the L1, the mean use was 3.417, $SD = .843$; for the L2, the mean use was 4.333, $SD = .434$.

Finally, another group of attriters was tested after being recently exposed exclusively to their L1 to explore whether attrition can decrease or disappear after

exposure to exclusively L1 input. This 'exposed' group (EXP) was formed by 24 Spanish native speakers (12 females, 12 males) who, as ATT, had been living in the UK for a minimum of five years and were near-native speakers of English (the mean number of years spent in the UK was 5.833, *SD* = 1.736). Also, like ATT, EXP used the L2 significantly more often than the L1 ($p < .001$). For the L1, the mean use was 2.583, *SD* = .880; for the L2, the mean use was 4.417, *SD* = .565. However, this group had been exposed exclusively to Spanish for a minimum of a week in a Spanish-speaking environment (i.e. Spain) during their Christmas holidays right before they were tested (the mean number of days that they were exposed to the L1 was 13.083, *SD* = 4.745).

As mentioned before, both groups of attriters, ATT and EXP, had at least 5 years of residence in the UK and used English significantly more often than Spanish. Therefore, following previous studies on L1 attrition, this long-term exposure to the L2 combined with limited exposure to the L1 is sufficient for syntactic attrition to occur (e.g. Tsimpli et al., 2004). Moreover, their English near-nativeness was assessed during the recruiting process and the experimental session, which were conducted in English, and with the questionnaire, where participants were asked to answer questions about when they started learning English, for how long, how and where they studied it, what is their proficiency level in listening, speaking, reading and writing, etc., and as mentioned above, to rate their use of English in different settings.

4.2 Stimuli

To explore whether structures at the syntax-pragmatics interface undergo attrition in the L1 under prolonged exposure to an L2, as predicted by the Interface Hypothesis, the interpretation and processing of overt versus null subject pronouns in Spanish was investigated, in which the antecedent preferences were predicted using Carminati's PAS (i.e. null pronoun: subject preference; overt pronoun: object preference). We used 32 intra-sentential semantically-neutral forward anaphora like the ones illustrated in (8). Each sentence consisted of a main clause, which contained a subject and an object antecedent of the same gender, followed by a subordinate clause always introduced by *cuando* "when" and followed by the subject pronoun, either overt or null, and a verb conjugated in third-person singular. The grammatical number of the antecedents was manipulated such that the pronoun could refer only to either the subject or the object antecedent. One antecedent carried singular number and the other plural number, in order to disambiguate. Since the pronoun and the verb were always in singular, they would co-refer with the antecedent in singular (in half of the items, the subject was singular and the object was plural, and in the other half, the subject was plural and the object was singular, as the four conditions in (8) show).

(8) a. Condition 1: **?Overt/subject match**[4]

La madre saludó a las chicas cuando ella cruzaba una calle con mucho tráfico.

The mother greeted-SG to the girls when she crossed-SG a street with a lot of traffic.

b. Condition 2: **Overt/object match**

Las madres saludaron a la chica cuando ella cruzaba una calle con mucho tráfico.

The mothers greeted-PL to the girl when she crossed-SG (…).

c. Condition 3: **Null/subject match**

La madre saludó a las chicas cuando *pro* cruzaba una calle con mucho tráfico.

The mother greeted-SG to the girls when *pro* crossed-SG (…).

d. Condition 4: **?Null/object match**

Las madres saludaron a la chica cuando *pro* cruzaba una calle con mucho tráfico.

The mothers greeted-PL to the girl when *pro* crossed-SG (…).

"The mother/s greeted the girl/s when (she) crossed a street with a lot of traffic."

There were four conditions of each item, two with an overt pronoun and the other two with a null pronoun. Moreover, half of the items included all female referents and the other half all male referents. The 32 items were divided into four lists and, using a Latin square design, each list contained one of the four conditions of each of the 32 items, and all conditions appeared the same number of times in each of the lists. In addition to the experimental items, 64 fillers were also randomly included in each list. The fillers included similar structures as the experimental items, but contained inanimate referents, proper names, plural pronouns, other conjunctions such as *mientras* "while", *para que* "so that", etc., as well as completely different grammatical structures.

All experimental items had the same number of words, except for the ones that contained a null pronoun, which had a word less.

4.3 Procedure

As mentioned above, participants carried out two tasks: a naturalness judgement task and an eye-tracking-while-reading task. The experimental session was designed to be carried out as a single task: in each trial, the participant had to read the sentence, which was shown on a computer screen, while his or her eye-movements were recorded, and then rate the sentence in terms of its naturalness. The experiment was run using an Eyelink 1000 tower-mounted eye-tracking system (SR Research) interfaced with a PC computer, which was connected to a 19 inch monitor that was situated around 30 inches from the eye-tracker. After participants had read the instructions, they were asked to sit in front of the eye-tracker and place their heads on the chinrest so that the eye-tracker could be fitted on their heads. Before the experiment started, a calibration process with their right eye was carried out until the calibration was successful. This process had to be repeated during the experiment if calibration failed. Eye movements were recorded from the right eye only, and the sampling rate for recordings was 1000 Hz.

The experiment began with three practice trials. For the trials to appear in the monitor screen, participants were instructed to look at the black square that appeared at the left edge of the white screen, which automatically triggered the sentence to appear in the position where the square was. Sentences were all

presented in one line and the font was Times New Roman, in black, size 18. They appeared on a computer monitor, and participants were instructed to read each sentence and then press a button on a game pad once they had comprehended it. When they pressed the button, the question *¿Cómo de natural te suena esta frase?* "How natural does this sentence sound to you?" followed and they were asked to rate the previous sentence on a 5-point scale in terms of their perceived naturalness (with 1 being 'not natural at all' and 5 being 'totally natural'). They were instructed to say their ratings out loud and their responses were recorded.

4.4 Data analysis

With regard to the eye-tracking data, using EyeDoctor.0.5.7 (http://www.psych.umass.edu/eyelab/software/), vertical drift in the position of fixations was corrected. We also deleted fixations that fell outside of the text boundaries[5] (less than 1% of all fixations). Finally, extremely short fixations (less than 80 ms), and extremely long fixations (more than 1200 ms) were also removed, affecting 2% of the data.

Moreover, items were divided into seven regions, as (9) illustrates. The critical region (region 5) contained the pronoun and the verb (in the case of sentences with null pronoun, only the verb was included).

(9) La madre/ saludó a/ las chicas/ cuando/ ella cruzaba/ una calle/ con mucho tráfico./

We report three different eye-movement measures: first-pass time, go-past time and total time. 'First-pass time' (*fp*) includes the summed duration of all the

fixations made in a particular region from the first time the eye enters the region until it leaves the region, so it does not include regressions to previous regions or subsequent returns to the particular region. 'Go-past time' (*gp*) includes the sum of all of the fixations made from the first entry into a region, including regressions to previous regions and well as returns to the particular region, up until the eye enters any subsequent region. 'Total time' *(tt*) includes the sum of all the fixations made in a particular region during the whole trial. The analysis did not include trials in which the relevant measure returned a zero value (for *fp* and *gp*, these trials correspond to cases where the region was skipped in initial reading [8.31% of trials]; for *tt*, these trials correspond to cases where the region received no fixations at all [3.41% of trials]).

Fp and *gp* are assumed to be informative about relatively early stages of processing, since they measure fixations that occur immediately after the region of interest is entered for the first time, and before subsequent material has been read. *Tt* is a more general measure of processing, since it may include fixations that are made when the region is re-fixated, after subsequent regions have been read.

For the analyses of both judgement and eye-tracking tasks, two factors were manipulated, each containing two levels: *Pronoun* (overt or null) and *Antecedent* (subject or object), which were combined to create a 2x2 factorial design. For the judgement data, a repeated-measures ANOVA with these two factors was run for each of the three groups. For the eye-tracking data, a repeated-measures ANOVA for each measure and region was run for each of the three groups.

Given this design, the crucial statistical outcome is the *Pronoun*Antecedent* interaction, which can be used to measure the tendency for null pronouns to prefer subject antecedents and overt pronouns to prefer object antecedents, in both the fixation time data and the rating data. This interaction effectively measures the *difference* between the two pronoun types in their degree of preference for subject vs. object antecedents, and thus controls for other extraneous factors that could potentially affect the overall referential bias within a given set of stimuli.

Finally, for the comparison between the groups, the factor *LanguageGroup* (MON, ATT or EXP) was included. This factor was between-participant, and within item. Repeated-measures ANOVAs (mixed design, in the case of the participant analysis) with the three factors were run for both the ratings data and the eye-movement data. These ANOVAs focused on three planned *a-priori* comparisons between pairs of groups, based on the theoretical predictions outlined below, namely MON vs. ATT, MON vs. EXP and ATT vs. EXP. We report analyses of the participant means collapsed over items (F1), as well as the item means collapsed over participant (F2).

4.5 Hypothesis and predictions

Two main hypotheses are tested in the present study, from which some predictions can be put forward:

(i) H_1: L1 attriters will show sensitivity to the pronoun mismatch in their offline interpretation, but not when processing this interface structure in real time.

Therefore, no differences are expected between MON, ATT and EXP with pronominal subjects in the offline task. All groups are predicted to show a significant interaction effect of *Pronoun*Antecedent* in their ratings, reflecting a greater degree of subject preference for the null pronoun (relative to that of overt pronoun), and/or a greater object preference for the overt pronoun (relative to that of the null pronoun). This interaction should arise due to relatively higher ratings for the conditions where pronoun and number information are in agreement (conditions 2 and 3) compared with their respective counterparts where these two information sources are in conflict (conditions 1 and 4). No significant three-way interaction of *Pronoun*Antecedent*LanguageGroup* is expected to be seen when comparing MON vs. EXP, MON vs. ATT or ATT vs. EXP, since the offline task should reveal no differences among the three groups in their knowledge representations.

On the other hand, ATT are expected to show less sensitivity to the pronoun mismatch than MON in the online task. The MON group are expected to show a *Pronoun*Antecedent* interaction in reading times (RTs), at or soon after the critical pronoun region is first encountered (see example 9 above for the regions). This interaction should reflect relatively short RTs for the conditions where number and pronoun information are in agreement (conditions 2 and 3), compared with their respective counterparts where these two information sources are in conflict (conditions 1 and 4). Previous eye-tracking studies of pronoun resolution, testing L1 speakers within an L1 environment, have detected very early effects of factors that influence the choice of subject vs. object antecedents; for example, in

an English study, effects have been found in *fp* RTs on the word after the pronoun (Featherstone & Sturt, 2009), or in a Dutch study, in *gp* at the pronoun itself (Koornneef & Van Berkum, 2006). Based on these observations, we expected the MON group to show the predicted interaction in the critical region in *fp* or *gp*.

In contrast, the ATT group are predicted to respond differently to the pronoun manipulation than the MON group. This may occur if the appearance of the *Pronoun*Antecedent* interaction is delayed in the eye-movement record relative to the MON group (e.g. occurring in a later region), or if it is completely absent in the eye-movement data. In either case, this should lead to a three-way interaction of *Pronoun*Antecedent*LanguageGroup* in the MON vs. ATT comparison at the pronoun region in measures of early processing.

(ii) H_2: attrition effects will decrease or disappear with recent exposure to the L1.

EXP are expected to perform similarly to MON in both online and offline tasks, so they are also predicted to show a *Pronoun*Antecedent* interaction in the eye-movement data. Moreover, EXP are expected to reveal no significant three-way interaction of *Pronoun*Antecedent*LanguageGroup* when compared to MON.

5. Results

5.1 Acceptability judgement task

This experiment consisted of an offline judgement task in which participants were given anaphoric sentences to read and then rate on a 5-point scale depending on

their perceived naturalness, in order to investigate whether participants showed any attrition effects in their offline interpretation of subject pronouns. Table 1 shows participants' score means for each condition.

<Insert Table 1 about here>

A repeated-measures ANOVA with the factors *Pronoun* and *Antecedent* was run for each of the three groups. The results revealed a significant main effect of *Pronoun* for all groups: MON ($F_1(1, 23) = 4.345$, $p = .048$; $F_2(1, 31) = 10.465$, $p = .003$), ATT ($F_1(1, 23) = 16.681$, $p < .001$; $F_2(1, 31) = 25.393$, $p < .001$) and EXP ($F_1(1, 23) = 4.935$, $p = .036$; $F_2(1, 31) = 20.595$, $p < .001$), which indicates that the type of pronoun presented in the stimuli had a significant influence on participants' scores, with the null pronoun being rated higher (i.e. more natural) than the overt by all groups. On the other hand, a main effect of *Antecedent* was only revealed by ATT ($F_1(1, 23) = 7.858$, $p = .010$; $F_2(1, 31) = 9.321$, $p = .005$), but not for MON ($F_1(1, 23) = 1.946$, $p = .176$; $F_2(1, 31) = 1.530$, $p = .225$) or EXP ($F_1(1, 23) = 3.640$, $p = .069$; $F_2(1, 31) = 2.745$, $p = .108$), which suggest that only ATT scores are influenced by the type of antecedent matching with the pronoun presented in the stimuli, with the subject antecedent being rated generally higher than the object by this group.

More importantly, a significant *Pronoun*Antecedent* interaction effect for all groups' ratings of anaphors was revealed. This interaction was significant only by subjects for MON ($F_1(1, 23) = 12.328$, $p = .002$; $F_2(1, 31) = 3.880$, $p = .058$) and EXP ($F_1(1, 23) = 5.403$, $p = .029$; $F_2(1, 31) = 2.793$, $p = .105$), and by subjects and items for ATT ($F_1(1, 23) = 16.468$, $p < .001$; $F_2(1, 31) = 19.936$, $p < .001$).

This indicates that the three groups of participants were sensitive to the mismatching conditions when interpreting subject pronouns offline.

To explore the nature of these interaction effects, paired samples t-tests were conducted with all groups to compare their interpretation of overt and null pronouns. As Table 1 shows, with the overt pronoun, all three groups rated significantly lower scores for the subject antecedent than for the object antecedent: MON ($t_1(23) = -3.158$, $p = .004$; $t_2(31) = -2.237$, $p = .033$), ATT ($t_1(23) = -2.804$, $p = .010$; $t_2(31) = -3.822$, $p = .001$) and EXP ($t_1(23) = -2.804$, $p = .010$; $t_2(31) = -3.822$, $p = .001$); and although the ratings for the null pronoun overall revealed higher scores for the subject antecedent than for the object antecedent, this difference was not significant for any of the groups: MON ($t_1(23) = 1.041$, $p = .309$; $t_2(31) = .577$, $p = .568$), ATT ($t_1(23) = .739$, $p = .467$; $t_2(31) = .858$, $p = .397$) and EXP ($t_1(23) = -.141$, $p = .889$; $t_2(31) = -.062$, $p = .951$).

Finally, group comparisons were conducted running a repeated-measures ANOVA with the factors *Pronoun*, *Antecedent* and *LanguageGroup* for MON vs. ATT, MON vs. EXP, and ATT vs. EXP. They revealed no three-way interaction effects of *Pronoun*Antecedent*LanguageGroup* for any of the group comparisons: MON vs. ATT ($F_1(1, 46) = .867$, $p = .357$; $F_2(1, 31) = 1.483$, $p = .232$), MON vs. EXP ($F_1(1, 46) = .456$, $p = .503$; $F_2(1, 31) = .112$, $p = .740$) and ATT vs. EXP ($F_1(1, 46) = 2.275$, $p = .138$; $F_2(1, 31) = 3.355$, $p = .077$). These results clearly indicate that, as it was predicted, there are no significant differences between any of the groups in terms of their offline preferences for subject pronouns.

5.2 Eye-tracking task

The online experiment consisted of an eye-tracking-while-reading task, in order to explore whether participants showed online sensitivity when processing pronominal subjects in real time.

For each of the three groups, a repeated-measures ANOVA with the factors *Pronoun* and *Antecedent* was run for each measure (*fp*, *gp* and *tt*) and region (although only the critical and post-critical regions are reported, since the analyses for the final region are non-significant or uninterpretable due to the massive wrap-up effects that take place in reading studies). Tables 2 and 3 show the RT means revealed by each group for *fp*, *gp* and *tt* in the critical and post-critical regions, respectively, while Figures 1, 2 and 3 show this information graphically, for the critical region.

<Insert Tables 2 and 3 and Figures 1, 2 and 3 about here>

A main effect of *Pronoun* was revealed by all groups of participants, consistently in the critical region for all three eye-movement measures, with the overt pronouns showing longer RTs than the null. The post-critical region also showed a main effect of *Pronoun,* for *tt*, with the trend in the opposite direction. The effect in the critical region is almost certainly due to the length difference between the sentences containing a null pronoun and the sentences containing an overt pronoun (the sentences with an overt pronoun contain one more word than the sentences with a null pronoun). Note, however, that although the *Pronoun* main effect is confounded with length, this does not affect the interpretation of the crucial *Pronoun*Antecedent* interaction reported below, since interactions in

ANOVA are independent of main effects. A main effect of *Antecedent* was revealed only by MON and EXP, and not by ATT, with the subject antecedent consistently showing longer RTs than the object. For MON, significant main effects of *Antecedent* were shown in the critical region for *fp* ($F_1(1, 23) = 4.358$, $p = .048$; $F_2(1, 31) = 5.945$, $p = .021$) and *tt*, although only by subjects ($F_1(1, 23) = 7.850$, $p = .010$; $F_2(1, 31) = 1.465$, $p = .235$). For EXP, significant main effects were shown for *fp* in the critical ($F_1(1, 23) = 7.138$, $p = .014$; $F_2(1, 31) = 7.507$, $p = .010$) and post-critical regions ($F_1(1, 23) = 4.493$, $p = .045$; $F_2(1, 31) = 5.568$, $p = .025$), for *gp* in the post-critical region ($F_1(1, 23) = 4.997$, $p = .035$; $F_2(1, 31) = 7.808$, $p = .009$) and for *tt* in the critical region ($F_1(1, 23) = 8.540$, $p = .008$; $F_2(1, 31) = 11.180$, $p = .002$).

Moreover, the repeated-measures ANOVA tests revealed significant *Pronoun*Antecedent* interaction effects only for MON and EXP, but not for ATT. The MON group showed interaction effects in the critical region for *fp* ($F_1(1, 23) = 12.391$, $p = .002$; $F_2(1, 31) = 6.199$, $p = .018$), for *gp* by subjects ($F_1(1, 23) = 4.889$, $p = .037$; $F_2(1, 31) = 1.962$, $p = .171$) and for *tt* by subjects ($F_1(1, 23) = 11.896$, $p = .002$; $F_2(1, 31) = 1.016$, $p = .321$). For the EXP group, the interaction effect in the critical region was significant for *tt* ($F_1(1, 23) = 9.963$, $p = .004$; $F_2(1, 31) = 11.502$, $p = .002$), and marginally significant for *fp* ($F_1(1,23) = 3.57$, $p = .072$; $F_2(1, 31) = 3.62$, $p = .067$) . The EXP group also showed an interaction in the post-critical region in *tt*, which was significant by subjects and marginal by items ($F_1(1, 23) = 4.644$, $p = .042$; $F_2(1, 31) = 3.906$, $p = .057$). Finally, for the ATT group, the *Pronoun*Antecedent* interaction did not approach significance in

any region, for any measure. This indicates that during online anaphora resolution, MON and EXP were sensitive to the mismatching conditions, but not ATT.

To explore the nature of these interaction effects, paired samples t-tests were conducted again with MON and EXP to compare their processing of overt and null pronouns. As suggested by Tables 2 and 3, and Figures 1, 2 and 3, the interaction for the MON and EXP groups is driven by significant differences between the two overt pronoun conditions (with longer RTs for the subject antecedent than the object antecedent), along with no significant differences between the two null conditions, (showing, in most cases, the opposite numerical pattern to the overt pronouns). For the MON group, the difference between the two overt pronoun conditions was found in the critical region for all measures: *fp* ($t_1(23) = 3.919$, $p < .001$; $t_2(31) = 3.023$, $p = .005$), *gp* by subjects ($t_1(23) = 2.130$, $p = .044$; $t_2(31) = 1.473$, $p = .151$) and *tt* by subjects ($t_1(23) = 4.712$, $p < .001$; $t_2(31) = 1.206$, $p = .237$). For the EXP group, the difference between the two overt conditions was found for both *fp* and *tt* in the critical region: *fp* ($t_1(23) = 2.60$, $p < .05$; $t_2(31) = 2.75$, $p < .05$) and *tt* ($t_1(23) = 3.632$, $p < .001$; $t_2(31) = 3.774$, $p < .001$) and for *tt* in the post-critical region ($t_1(23) = 2.457$, $p = .022$; $t_2(31) = 2.617$, $p = .014$). In contrast, the difference between the two null conditions was not reliable for any of these comparisons (all p's > .25).

Finally, group comparisons were conducted running a repeated-measures ANOVA with the factors *Pronoun*, *Antecedent* and *LanguageGroup* for MON vs. ATT, MON vs. EXP, and ATT vs. EXP for all measures and regions. The

ANOVA tests revealed a three-way interaction of *Pronoun*Antecedent*LanguageGroup* for MON vs. ATT for *fp* in the critical region by subjects ($F_1(1, 46) = 5.064$, $p = .029$; $F_2(1, 31) = 2.047$, $p = .163$), which reveals that there are differences between MON and ATT in terms of how they are affected by the pronoun mismatch in their online processing of these anaphora. The pattern of these three-way interaction effects in the critical region were explored and they appear to be due to the fact that MON showed the expected *Pronoun*Antecedent* interaction in *fp*, while ATT did not.

Moreover, as predicted, no significant three-way interaction effects were found when MON and EXP were compared, which reveals that the attrition effects of this exposed group have decreased as a result of their re-exposure to the L1. Interestingly, when ATT and EXP were compared, no significant three-way interaction effects were found between these two groups either, which suggests that EXP might be somewhere between MON and ATT in terms of their online sensitivity to the pronoun mismatch.

6. Discussion

The present study aimed to explore three main research questions. First, whether attriters showed indeterminacy with an interface structure like pronominal subjects, as predicted by the Interface Hypothesis (Sorace & Filiaci, 2006). Second, whether attrition affects online sensitivity when processing these interface structures in real time or whether it is due to permanent changes in attriters' L1 knowledge representations. Finally, whether attrition effects decrease

or disappear due to frequency and recency of re-exposure to the L1, as predicted by the ATH (Paradis, 1993).

Since we explored attrition in the interpretation and processing of an interface structure, no difference between the groups was predicted for the acceptability judgment task with subject pronouns, but attriters were expected to show reduced online sensitivity to this structure and, consequently, to perform differently from monolinguals in the eye-tracking task. As expected, the results from the naturalness judgements revealed equal mismatch sensitivity to subject pronouns for all three groups of participants. In the eye-tracking task, the monolinguals showed very early sensitivity to the pronoun preferences, resulting in a robust *Pronoun*Antecedent* interaction in first-pass reading times on the critical region. This same first-pass interaction was close to traditional levels of significance for the exposed group, and was accompanied by the same pattern of significance in the paired contrasts as that of the monolingual group. Moreover, the exposed group also showed a robust interaction in total time in the critical region, confirming that the pronoun preferences for this group were operative online, during the reading of the sentence. In contrast, the attriters did not show any evidence for a *Pronoun*Antecedent* interaction in any measure, indicating a lack of online sensitivity to the pronoun mismatch. Overall, the results from the eye-tracking experiment revealed that, in online reading, the monolingual and exposed groups are reliably more sensitive than attriters to the pronoun mismatch (i.e. overt pronoun when null pronoun is appropriate or null pronoun where overt pronoun is appropriate). Therefore, we can conclude that L1 Spanish attrited

speakers show attrition effects with the interface structure involving pronominal subjects.

This pattern of results is what would be expected based on the ATH, which predicts that attrition diminishes with frequency and recency of re-exposure to the L1. Thus, the exposed group was expected to show online sensitivity to the pronoun mismatch and, consequently, to perform similarly to monolinguals due to the fact that they had recently been exposed to their L1. As discussed above, the results obtained for the exposed group did not reveal attrition effects with pronominal subjects, since this group, unlike the attriters, showed a reliable sensitivity to the pronoun mismatch when processing this interface structure in real time. Moreover, when they were compared to the monolinguals, no significant differences between the two groups were revealed, which suggests that attrition effects diminish after recent exposure to the L1.

However, when the exposed group was compared to the attriters, no significant differences between the two groups were shown either. Therefore, given the significant differences between monolinguals and attriters, it might be the case that the exposed group is somewhere in between the attriters and the monolinguals; that is, their attrition effects have clearly diminished after having been exposed exclusively to the L1 for a period of time, but not to the point of behaving native-like. The exposed group may also have shown a slightly delayed sensitivity to the pronoun biases relative to the monolingual group, given that the monolingual group showed robust effects in first pass in the critical region, while the most robust effects for the exposed group emerged in total time. The question

now is whether attrition effects with interface structures such as subject pronouns just cannot be completely overcome or whether it is a matter of the length of re-exposure to the L1, so that a longer exposure might be needed for attriters to totally reverse attrition effects and behave again like monolingual speakers.

Finally, based on the judgment data, which shows no significant differences between the three groups, and also based on the fact that the monolingual and exposed groups do not reveal significant differences in their online results, it is clear that no permanent change in the attriters' L1 declarative knowledge representations takes place. On the one hand, we found that, despite attriters' lack of online sensitivity to the pronoun preferences, this group behaved like the monolingual and exposed groups in the judgment task, with all groups of participants showing an equal sensitivity to the pronoun mismatch. On the other hand, it was found that the monolingual and exposed groups did not show significant differences in the eye-tracking task. These results reveal that the exposed group was able to partially overcome their attrition with recent re-exposure to their L1 and therefore, that no permanent changes took place in their L1 knowledge representations.

One aspect of the results that deserves comment is the finding that participants generally had a clear preference for the object as the antecedent for the overt pronoun, while the preference for the null pronoun was less clear; generally, subject vs. object matching null pronouns did not differ significantly in ratings or eye-movement measures, for any of the three groups. At first sight, this pattern seems to be at odds with previous findings that suggest that native speakers of

Spanish consistently assign the subject antecedent to a null pronoun, whereas the overt pronoun is more flexible and not so strictly assigned to the object antecedent (Filiaci, 2010; Filiaci et al., 2013). However, our study may not be fully comparable to those earlier studies. One possible reason for this is the difference in tasks; Filiaci, (2010) and Filiaci et al (2013) combined a reading time measure with comprehension questions, while we combined a reading time measure with an acceptability judgement task. It is possible that this task difference may have affected the relative preference for subject versus object antecedents. A second possible reason is related to clause order. The clause order in our study was Main-Subordinate, while the earlier studies that showed clear preferences for null subjects used Subordinate-Main order, which may also have affected the overall referential bias in the stimuli. In fact, Filiaci (2010) includes two experiments in which she tests Main-Subordinate anaphora, and her results are similar to the ones presented here, with the overt pronoun revealing a strong bias for the object antecedent and the null pronoun a weak preference for the subject antecedent for both Italian and Spanish speakers.

Interestingly, Carminati's (2002) PAS was also based on Subordinate-Main anaphora. However, she conducted a questionnaire study including Main-Subordinate anaphora with temporal clauses, which are the kind of anaphora used in the present experiment, and her results revealed that more object antecedents were assigned to null pronouns in Main-Subordinate anaphora than in other types of clauses. Moreover, other studies in Italian have also found a strong preference of the object as the antecedent for the overt pronoun and a weaker subject bias for

the null pronoun (Fedele & Kaiser, 2012; Sorace & Filiaci, 2006), and a similar bias towards the object antecedent has been found with German demonstrative pronouns (Bosch, Katz & Umbach, 2007; Bosch, Rozario & Zhao, 2003; Bosch & Umbach, 2007).

7. Conclusions

Considering all the findings obtained from this study, we can conclude that attrition effects decrease as a result of L1 re-exposure. This reveals that bilinguals are sensitive to input changes and that attrition affects online sensitivity rather than causing a permanent change in speakers' L1 knowledge representations. Therefore, the results obtained from the present study clearly support Sorace's (2011) proposal that individual L1 attrition affects only the ability to process interface structures but not knowledge representations themselves. Future research is needed to identify precisely which aspects of processing pronominal dependencies are affected by attrition.

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[1] 'Optionality' refers to the indeterminacy shown by L2 learners when they encounter an interface structure, due to the coexistence in the speakers' grammar of two or more variants of a construction that share the same meaning and lexical resources (i.e. the alternation between target and non-target items).

[2] A reviewer asks whether the Interface Hypothesis would predict the asymmetric results obtained by Tsimpli et al. (2004): namely, the fact that only the Italian participants show evidence of attrition in the first PVT and only the Greek participants show it in the second. The explanation for these asymmetries lies in a number of factors that became apparent in subsequent research. First, not all null-subject languages are alike in all respects: for example, Filiaci et al. (2013) demonstrate how both Spanish and Italian allow the omission of subject pronouns and have the same inventory of pronominal forms, but do not have the same distribution of these forms due to different mappings with pragmatic conditions. In the Tsimpli et al. study, both Greek and Italian allow postverbal subjects: however, definiteness turned out to play a role in the distribution of postverbal subjects in Greek but not in Italian, which is arguably related to the fact that Italian is an SVO language but Greek is a VSO language. Thus, complete convergence between the two groups with respect to attrition effects in this domain cannot be expected. Second, more recent studies have questioned the correlation between the two classic properties of the Null Subject Parameter: the availability of null subject pronouns and that of postverbal subjects. In a study of very advanced non-native Italian speakers, Belletti et al. (2007) show that the two properties are dissociated since postverbal subjects are significantly more

inconsistent than null subjects in the performance of late bilinguals. This dissociation is likely to be related to the different discourse and lexical conditions affecting the two properties, which may involve non-linguistic cognitive abilities to varying degrees. The general implication is that predictions on the effects of attrition on the syntax-pragmatics interface should take into account both cross-linguistic differences in the realization of similar properties and intra-linguistic differences among properties that broadly exhibit this type of interface.

[3] A reviewer raises the question of why it is the marked form and not the reduced form that is overextended in L1. One reason might be that the overt pronoun is the least ambiguous form and the one that, by virtue of its phonetic content, allows the speaker more time for further linguistic computations. Furthermore, the marked form is the one associated with more than one interpretation: as Tsimpli (2011) argues, it becomes the speaker's default by losing its context/discourse sensitive features, which broadens the range of contexts in which it can be used. The default status of the overt pronoun is also found in pidgins, which tend to have only overt subject pronouns even when the substrate languages allow null pronouns (Bresnan, 2000).

[4] The notation '?' expresses that in those sentences the antecedent that the verb agrees in number with is the pragmatically infelicitous choice, not that those sentences are ungrammatical.

[5] These boundaries are pre-defined by the analysis software.

Table 1. *Score means and (SD) for offline anaphora resolution by all groups.*

Condition	MON		EXP		ATT	
?overt/subj	3.26	(.87)	3.15	(.62)	2.91	(.72)
overt/obj	3.60	(.75)	3.49	(.56)	3.45	(.82)
null/subj	3.72	(.67)	3.58	(.59)	3.64	(.73)
?null/obj	3.61	(.60)	3.59	(.59)	3.54	(.77)

Table 2. *First-pass, go-past and total time RT means and (SD) in the critical region (ella/pro cruzaba) by the three groups.*

Condition	MON		EXP		ATT	
first-pass						
?overt/subj	472	(156.17)	481	(120.89)	449	(154.40)
overt/obj	395	(93.86)	428	(109.12)	427	(118.03)
null/subj	263	(51.61)	283	(80.09)	278	(81.44)
?null/obj	285	(94.52)	270	(65.78)	267	(55.19)
go-past						
?overt/subj	672	(249.52)	612	(224.36)	542	(233.35)
overt/obj	568	(180.15)	525	(188.82)	472	(171.78)
null/subj	361	(132.10)	360	(134.94)	391	(161.46)
?null/obj	396	(159.70)	382	(189.63)	350	(161.64)
total time						
?overt/subj	1147	(518.12)	1288	(551.46)	1188	(322.21)
overt/obj	941	(496.48)	1003	(400.66)	1070	(401.10)
null/subj	574	(316.73)	702	(334.78)	701	(259.54)
?null/obj	624	(296.31)	673	(266.60)	685	(257.15)

Table 3. *First-pass, go-past and total time RT means and (SD) in the post-critical region (una calle) by the three groups.*

Condition	MON		EXP		ATT	
first-pass						
?overt/subj	383	(103.16)	394	(128.15)	373	(80.35)
overt/obj	382	(93.11)	373	(118.89)	350	(98.41)
null/subj	414	(165.76)	403	(93.45)	366	(98.34)
?null/obj	406	(122.63)	369	(87.66)	372	(120.14)
go-past						
?overt/subj	548	(236.25)	629	(296.96)	542	(196.60)
overt/obj	507	(185.57)	487	(208.09)	541	(243.78)
null/subj	562	(231.11)	528	(201.60)	529	(174.68)
?null/obj	568	(224.20)	487	(181.89)	516	(199.70)
total time						
?overt/subj	867	(306.04)	940	(449.03)	946	(358.25)
overt/obj	825	(304.89)	788	(316.73)	910	(366.59)
null/subj	949	(368.56)	983	(439.76)	1037	(348.72)
?null/obj	979	(378.94)	1020	(433.07)	1078	(347.70)

Figure 1. First-pass RT in the critical region (ella/*pro* cruzaba) by the three groups.

Figure 2. Go-past RT in the critical region (ella/*pro* cruzaba) by the three groups.

Figure 3. Total time RT in the critical region (ella/*pro* cruzaba) by the three groups.

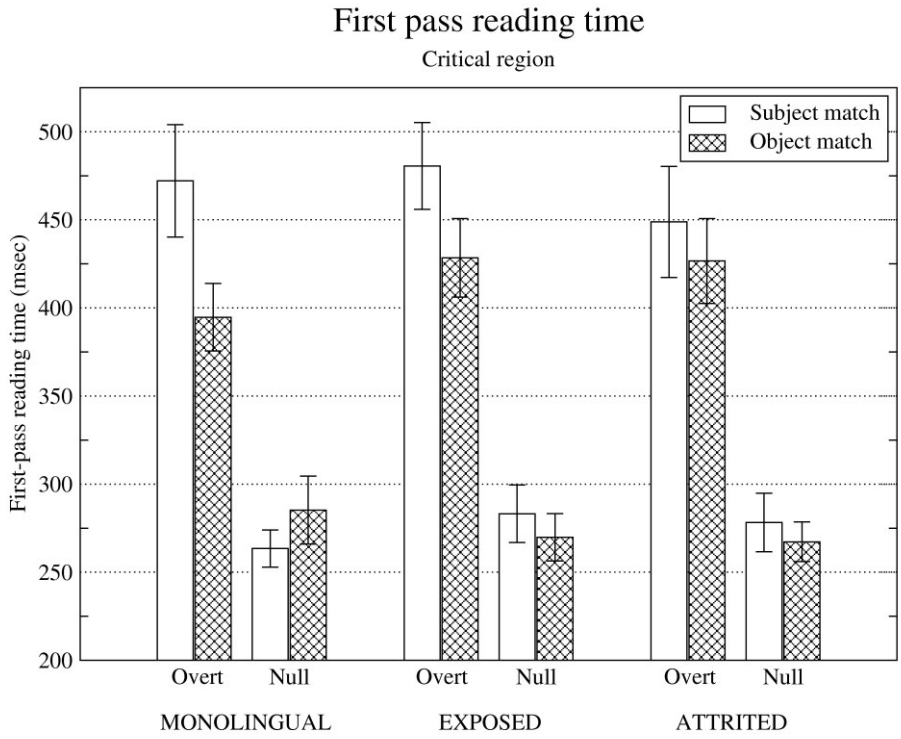

Figure 1. First-pass RT in the critical region (ella/pro cruzaba) by the three groups.
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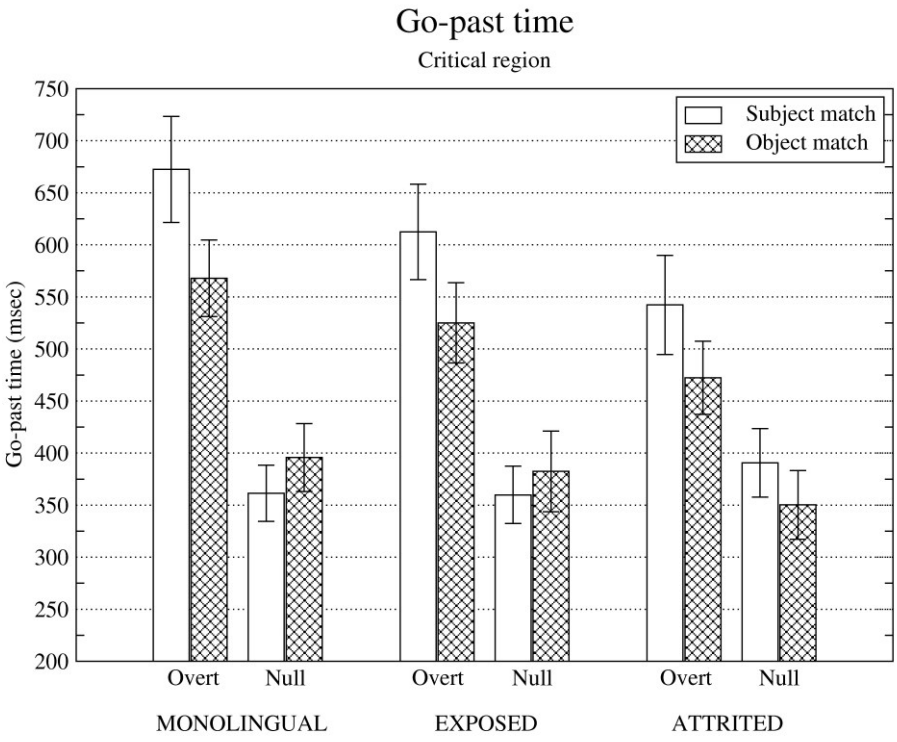

Figure 2. Go-past RT in the critical region (ella/pro cruzaba) by the three groups.
(215x166mm (300 x 300 DPI)

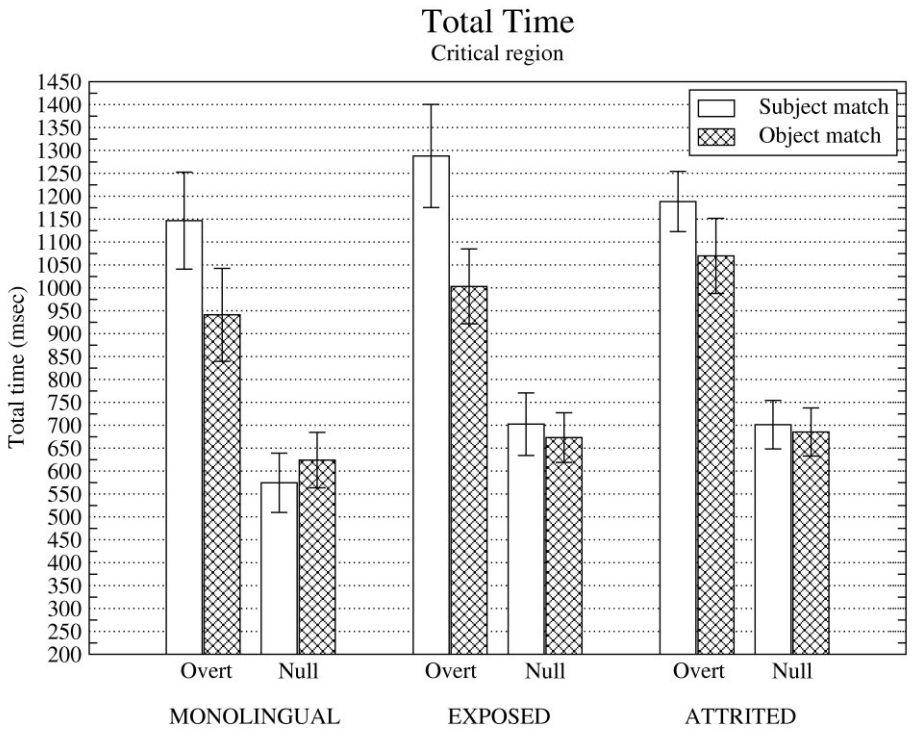

Figure 3. Total time RT in the critical region (ella/pro cruzaba) by the three groups.
215x166mm (300 x 300 DPI)